

# Risk factors for dislocation arthropathy after Latarjet procedure: a long-term study

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## Abstract

**Purpose** The purpose of this study was to analyse the long-term incidence of dislocation arthropathy after a modified Latarjet procedure for glenohumeral instability.

**Methods** Long-term follow-up information was obtained from a consecutive series of patients who had undergone a modified Latarjet procedure by one surgeon between 1986 and 1999. Multivariable regression analysis was performed to examine the relation between the development of a dislocation arthropathy and patients and surgery-related factors.

**Results** There were 117 patients (117 shoulders) for evaluation, (35 women and 82 men) with a mean age  $28.4 \pm 8.5$

(range, 16–55). The mean follow-up was 16.2 years (range, ten to 22.2 years). Signs of dislocation arthropathy were found in 36 % of patients, graded as Samilson 1 in 30 %, Samilson 2 in 3 %, and 3 % Samilson 3 in 3 % of patients. Risk factors for dislocation arthropathy included surgery in patients older than 40 years of age (64.3 vs. 34.4 %; adjusted RR 2.2, 95 % CI 1.7–2.9) and lateral positioning of the transferred coracoid process in relation to the glenoid rim (82.4 vs. 30.4 %; adjusted RR 2.3, 95 % CI 1.7–3.2). Patients with hyperlaxity developed less dislocation arthropathy (15 vs. 42.5 %; adjusted RR 0.4, 95 % CI 0.1–0.95). **Conclusion** The development of dislocation arthropathy after the Latarjet procedure remains a source of concern in the long term. It correlates with surgery after the age of 40 and lateral coracoid transfer in relation to the glenoid rim. On the other hand, hyperlaxity seems to have a protective effect on the development of dislocation arthropathy.

**Level of evidence** Level III, therapeutic case series.

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## Introduction

The Latarjet procedure [1] and its subsequent modifications [2, 3] are becoming increasingly popular and are currently considered as an efficient method to stabilise the shoulder primarily or after recurrent dislocation [4, 5]. The procedure can be performed open [6, 7] or arthroscopically [8, 9]. Only a few studies with a large sample size have reported long-term outcomes [10–13], and only one has focused on dislocation arthropathy as defined by Samilson, which can occur after either shoulder dislocation or surgical repair [14].

Several risk factors such as patient age at the time of surgery or the details of the procedure itself have been described and might be responsible for the development of dislocation arthropathy following anterior shoulder stabilisation [11, 13–15].

The objective of this study was first to evaluate the long-term clinical results of a modified Latarjet procedure and second to establish the incidence of dislocation arthropathy, its risk factors, and its relation to clinical results.

## Materials and methods

### Patient selection

We performed a retrospective review of 324 patients who had undergone an open modified Latarjet procedure by the senior author (DFG) from January 1986 to November 1999. The inclusion criteria included a primary bone Latarjet procedure, a minimum follow-up of ten years, and complete preoperative medical records. Exclusion criteria included a previous bone block procedure such as Eden-Hybinette stabilisation [16, 17], lack of follow-up data, and incomplete radiographic examination.

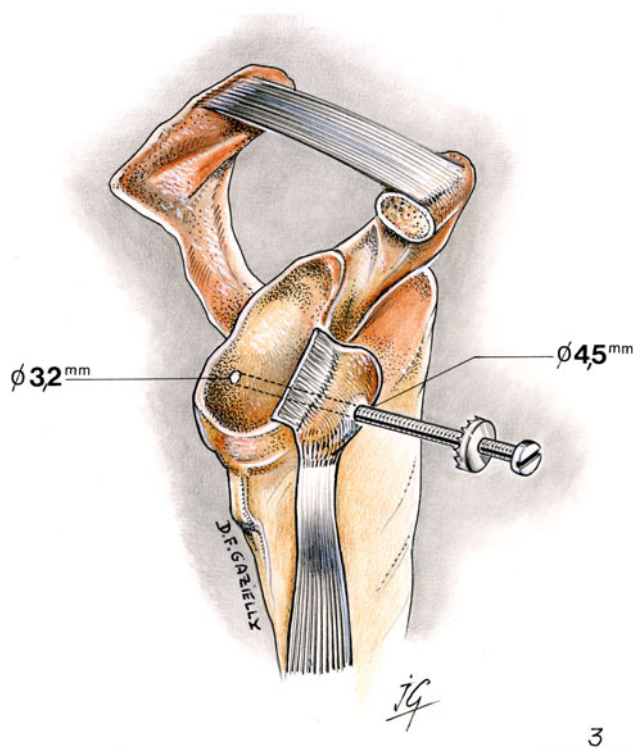
### Surgical technique

The surgical technique for the open Latarjet procedure has been previously described [1, 4]. The senior author who performed all the operations in this study used a modified operative technique. The approach was delto-pectoral with an L-shaped incision in the superior two-thirds of the subscapularis muscle. Drilling was done through the horizontal part of the coracoid, the graft was attached, flush to the glenoid neck below the equator, in a supine position with a 4.5-mm cortical screw and washer (Fig. 1). All patients took part in a standardised rehabilitation protocol [18].

### Study variables

The outcomes of interest were (1) the long-term clinical results and (2) the long-term incidence of dislocation arthropathy. Additionally, the incidences of other radiological complications such as osteolysis, migration, fracture, or pseudarthrosis were recorded.

Long-term clinical results were assessed using a patient-administered questionnaire including (1) the Walch-Duplay score [19] (maximum of 100 points) which is a functional score consisting of objective as well as subjective parameters, and has been used to classify sports activities and pain; (2) the Walch-Duplay pain score is graded from 0 points (pain during activities of daily living) to 25 points (no pain); (3) hyperlaxity as defined by external rotation greater than 90° with the elbow at the side [4], whereby the method of self-determining forward elevation has been previously validated [20]; (4) patient satisfaction (very satisfied, satisfied or dissatisfied); (5) return to sports or activities (yes/no); and (6) need for repeat surgery. In addition, the following



**Fig. 1** The coracoid and glenoid have been drilled using 4.5- and 3.2-mm drill bits, respectively. The coracoid graft is secured to the anterior glenoid by means of a 4.5-mm screw and washer

baseline characteristics were assessed: age, sex, and side of surgery.

### Radiological evaluation

At latest follow-up patients underwent radiological evaluation including anteroposterior views in internal and external rotation, one subcoracoid view [10] and one Bernageau view [21]. All radiographs were independently assessed by two orthopaedic surgeons who had not been involved in the surgical procedures. The diagnosis of dislocation arthropathy was defined according to the Samilson criteria [14], which takes into account the appearance of the glenohumeral joint and the size of inferior humeral and/or glenoid osteophytes. Mild arthritis was diagnosed when osteophytes were less than three millimetres. When the osteophytes measured between three and seven millimetres with mild gleno-humeral irregularity, arthropathy was classified as moderate. Severe arthropathy was recorded if there was severe sclerosis of the glenohumeral joint or if the osteophytes were greater than seven millimetres in height.

The position of the graft was considered too far lateral if any part of the screw, washer or graft itself was overhanging lateral to the joint line on the Bernageau view. The position was too far medial if the lateral aspect of the coracoid was greater than four millimetres medial to the joint line.

Osteolysis, migration, fracture, or pseudarthrosis of the graft was recorded using the criteria of Hovelius et al. [22]. The graft was considered as united when there was no visible radiolucent zone between the graft and the scapular neck on all radiographs. Pseudarthrosis was diagnosed when the graft showed separation from the scapular neck by a radiolucent zone not wider than five millimetres. If greater than five millimetres the graft was classified as migrated.

### Statistical analysis

To determine risk factors for dislocation arthropathy defined as presence of mild to severe arthritis (Samilson grade 1–3) we calculated crude and adjusted risk ratios (RR) and their 95 % confidence intervals (CI). Adjusted risk ratios were obtained with the use of the general linear model (GLM) for the binomial family (STATA version 11.1).

Sex, dominant side and sports activity were not included in the multivariable model, because no substantial effect on the risk of developing dislocation arthropathy was seen in the univariate analyses.

To evaluate whether the presence or absence of arthropathy influenced clinical results, the unpaired Student's *t*-test for continuous variables and the chi-square test for categorical variables was used to obtain *p*-values.

### Ethics

Patients gave their permission to be included in this consecutive series. Ethical Committee approval was not required.

## Results

### Demographic data

All eligible patients were contacted for study recruitment. Of the 324 patients who had undergone the procedure during the study interval, 207 did not respond. Thus there were 117 patients (117 procedures, 35 women and 82 men) with a mean age of  $28.4 \pm 8.5$  years (range, 16–55 years) for final analysis. Of those 110

patients could be graded for the presence or absence of dislocation arthropathy. Mean follow-up was 16.2 years (range, ten to 22.2 years).

### Complications

Postoperative complications included one postoperative infection, one transient lesion of the musculocutaneous nerve, and one superficial vein thrombosis.

### Long-term clinical outcomes

Thirty-two patients (17 %) had hyperlaxity. Four patients reported persistent apprehension. However, none of them showed hyperlaxity. Two patients (1.7 %) sustained a re-dislocation or re-subluxation, but none required further operation. The mean Walch-Duplay score was  $92.8 \pm 10.3$  (range, 25–100), and results were good or excellent in 97.4 % of cases. Sixty percent of patients were pain free, 37 % described occasional pain, and 3 % of patients suffered from pain during activities of daily living. Seventy-eight percent of patients were very satisfied, 18 % were satisfied and 3 % were dissatisfied with their outcome. Return to sports activities was possible for 83 % of the patients.

### Radiological results

Radiological complications included two patients with a pseudarthrosis (1.7 %), four cases of osteolysis (3.4 %), one fracture (0.9 %), and one migration (0.9 %). The presence of dislocation arthropathy was found in 42 of 110 patients (36 %). Of those 30 % were graded Samilson 1, 3 % Samilson 2 and 3 % were graded Samilson 3 (Fig. 2). The coracoid was positioned laterally to the glenoid in 19 patients (14.5 %). Risk factors for dislocation arthropathy (Table 1) in the multivariable analysis were surgery in patients older than 40 years of age compared to those younger than 40 (64.3 % vs. 34.4 %; adjusted RR 2.2, 95 % CI 1.7–2.9) and lateral positioning of the transferred coracoid process in relation to the glenoid rim (82.4 % vs. 30.4 %; adjusted RR 2.3, 95 % CI 1.7–3.2). Presence of hyperlaxity was protective (15 % vs. 42.5 %; adjusted RR 0.4, 95 % CI 0.1–0.95). No difference in risk was seen regarding sex, sports activity and dominant side.

**Fig. 2** Samilson 1 (a), 2 (b) and 3 (c) dislocation arthropathy was found in 30 %, 3 % and 3 % of cases, respectively



**Table 1** Association between potential risk factors and presence of radiographic osteoarthritis (Samilson grades 1–3)

Potential risk factors	Samilson grade 1–3	Total (n)	Crude risk ratio (95 % CI)	Adjusted risk ratio (95 % CI) <sup>c</sup>
Men (%)	30 (39.5)	76	Ref.	
Women (%)	12 (35.3)	34	0.9 (0.5–1.5)	
Age at operation (%)				
<40 years	33 (34.4)	96	Ref.	
≥40 years	9 (64.3)	14	1.9 (1.2–3.0)	2.2 (1.7–2.9)
Dominant side (%) <sup>a</sup>				
No	20 (39.2)	51	Ref.	
Yes	19 (33.9)	56	0.9 (0.5–1.4)	
Sports activity (%)				
No	7 (41.2)	17	Ref.	
Yes	35 (37.6)	93	0.9 (0.5–1.7)	
Lateral overhanging of the graft relative to the glenoid (%)				
No	28 (30.4)	92	Ref.	
Yes	14 (82.4)	17	2.7 (1.9–4.0)	2.3 (1.7–3.2)
Hyperlaxity (%) <sup>b</sup>				
No	37 (42.5)	87	Ref.	
Yes	3 (15.0)	20	0.4 (0.1–1.0)	0.4 (0.1–0.95)

<sup>a</sup> Information on dominant side was missing for three patients

<sup>b</sup> Hyperlaxity was defined as an external rotation of more than 85° elbow at the side; information was missing for three patients

<sup>c</sup> We used the general linear model (GLM) for the binomial family (STATA version 11.1) to obtain adjusted risk ratios and their 95 % confidence intervals

None of the clinical outcome parameters except for patient satisfaction differed substantially between patients with dislocation arthropathy and those without (Table 2). Patients with radiological signs of arthropathy chose more often the rating “satisfied” instead of “very satisfied” as compared to those without arthropathy ( $p=0.012$ ).

## Discussion

The results of this study indicate that the long-term clinical results of the modified Latarjet procedure are good in terms of stability, pain, return to sports and patient satisfaction. Similar clinical results have previously been described

following this procedure and its subsequent modifications [23–25].

A rate of re-dislocation or re-subluxation has been reported by several author as ranging between 0 and 10 % [5, 12, 23–25]. In our study there were only two patients (1.7 %) who sustained a re-dislocation or re-subluxation, but there were four other patients (3.4 %) who felt that their shoulder was not stable. There was no correlation between this finding and the presence of arthropathy. A possible explanation for this discrepancy may be that some patients still suffer from apprehension despite a stable shoulder.

The aetiology of dislocation arthropathy is controversial. Lateral protrusion of the graft or osteosynthesis material is known to lead to secondary arthritis [10, 26]. However,

**Table 2** Long-term clinical outcomes according to presence or absence of dislocation arthropathy

Outcome measure	Presence of arthropathy (Samilson grade 1–3) (n=42)	Absence of arthropathy (n=68)	p-value <sup>a</sup>
Walch-Duplay score, mean (SD)	91.7 (±9.8)	93.7 (±10.3)	0.313
Walch-Duplay pain score (%)			0.927
None	25 (59.5)	42 (61.8)	
Occasional	16 (38.1)	25 (36.8)	
Pain during daily activities	1 (2.4)	1 (1.5)	
Sports activity yes (%)	35 (83.3)	58 (85.3)	0.782
Satisfaction (%)			0.012
Very satisfied	26 (61.9)	59 (86.8)	
Satisfied	15 (35.7)	7 (10.3)	
Dissatisfied	1 (2.4)	2 (2.9)	

Overall, 110 patients had complete information on Samilson grades and clinical outcomes

<sup>a</sup> p-values were obtained with use of the unpaired Student's *t*-test for continuous variables and chi-square test for categorical variables



while 14.5 % of patients had such an overhang dislocation arthropathy was found in 36 % of patients as a whole. This difference is probably related to the natural history of this disorder and not the surgery itself, a point previously noted by Hovelius et al. [10]. The 30 % incidence of dislocation arthropathy found in our study is similar (19–30 %) to other series [12, 13, 27]. The radiological findings did not correlate with functional outcome but with patient satisfaction.

Dislocation of the shoulder prior to 22 years of age is a risk factor for recurrent dislocation [28]. Undergoing shoulder stabilization after the age of 40 is a risk factor for the development of dislocation arthropathy. Indeed, a prolonged delay between the initial dislocation and surgery contributes to a greater likelihood of developing dislocation arthropathy. Perhaps this finding might be explained by a greater number of shoulder dislocations or subluxations prior to stabilisation. An additional factor may be less favourable biology secondary to aging which correlates with poorer cartilage properties and less capacity for self-repair, leading to extended cartilage damage at the time of stabilisation. Surprisingly, Hovelius et al. did not find a similar relationship [10]. Hyperlaxity, on the other hand, had a protective effect on dislocation arthropathy in our study. Some authors [13] have postulated that subluxation of the shoulder remains possible after a Latarjet procedure and the repeated sliding of the humeral head leads to arthropathy. Conversely, we believe that hyperlaxity may decrease postoperative contact pressure of the humeral head on the glenoid and thus prevent development of secondary arthritis.

### Strengths and limitations

A major strength of our study is the long follow-up after the Latarjet procedure, which is one of the longest to date. As an increasing number of Latarjet procedures are being performed, a better understanding of factors that contribute to dislocation arthropathy is crucial. An additional strength is that all operations were performed by a single surgeon who used the same techniques for repair according to the type of lesion. Limitations include the retrospective design that led to a high loss to follow-up rate, and the inability to determine the number of previous dislocations or subluxations prior to surgery. This information might have correlated with the development of dislocation arthropathy, as such a link probably exists. Additionally, since only postoperative imaging for the ipsilateral side was available it was impossible to compare the incidence of postoperative dislocation arthropathy to preoperative or contralateral side arthritis.

### Conclusion

The development of dislocation arthropathy after the Latarjet procedure remains a source of concern in the long term. It correlates with surgery after the age of 40 and lateral coracoid transfer in relation to the glenoid rim. On the other hand, hyperlaxity seems to have a protective effect on the development of dislocation arthropathy.

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